ASSESSMENT OF MARKET OPPORTUNITIES FOR U.S. HWW IN SELECTED LATIN AMERICAN COUNTRIES

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CHAPTER I

INTRODUCTION

World wheat consumption was estimated at 640.7 Million Metric Tons (MMT) for the marketing year 2008/09; this is up 3 percent compared to the previous marketing year 2007/08 (FAS-USDA 2010).Wheat comes second in importance after corn (775 MMT), in terms of worldwide consumption. For the marketing year 2008/09 the world four largest wheat producers were: the European Union-27, China, India, and the U.S. respectively, accounting for 60 percent of the world total production (FAS-USDA 2010).

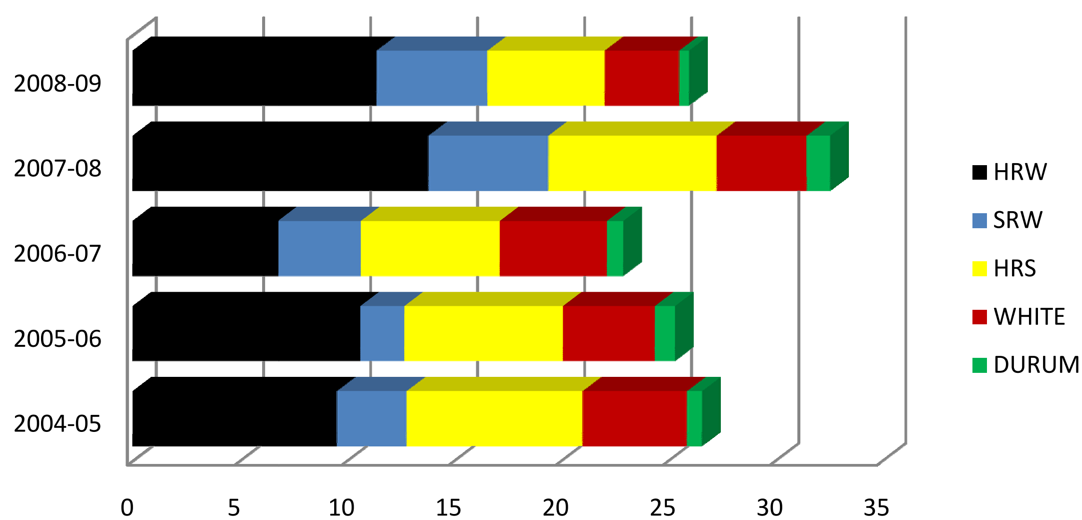
The U.S. produces six types of wheat: Hard Red Winter (HRW), Hard White Winter (HWW), Hard Red Spring (HRS), Soft Red Winter (SRW), Soft White Winter (SWW), and Durum (DUR). In terms of total production, during the last three years (2007-2009) HRW, SRW, and HRS have been the principal wheat classes grown in the U.S. (table I-1).

Exports are vital for the profitability of the U.S. wheat industry. In the last five marketing years 2004/05 to 2008/09, the total U.S. wheat exports have fluctuated from 22.90 Million Metric Tons (MMT) for the marketing year 2006/07 to 32.56 MMT for the marketing year 2007/08. The leading exported classes were HRW and HRS (figure I-1).

Table I-1. U.S. Total Wheat Production by Class, 2007-2009 (1,000 Bushels)

	Winter Wheat			Spring Wheat		
Year	**Hard Red**	**Soft Red**	**Hard White**	**Hard Red**	**Soft White**	**Durum**
2007	955,555	352,026	27,039	450,070	193,904	72,224
2008	1,034,694	613,578	29,042	512,138	225,885	83,827
2009	919,015	403,563	25,993	547,933	210,625	109,042

Source: NASS, USDA



Source: USDA/FAS/Export Sales Reporting.
Figure I-1. U.S. Total Wheat Exports by Class (Million Metric Tons)

Hard White Wheat (HWW) is the newest class of wheat marketed in the U.S. The Grain Inspection, Packers and Stockyards Administration (GIPSA) established the Hard White wheat class on May 1, 1990 (Federal register 2005). Nevertheless, HWW is not new to the rest of the world; it is Australia's major exported wheat. HWW has several milling and final product advantages: because of the bran's color it yields 1 to 3 percent more flour per bushel than HRW when both are milled to color standards, whole wheat food products made of HWW have a milder flavor and a less bitter taste than products made from HRW flour, also food products made of HWW may be more appealing to many customers who favor whiteness along with higher fiber and mineral contents (Lin and Vocke 2004).

The U.S. production of HWW was limited in the past mainly due to agronomic problems such as sprout damage which has a negative effect on both test weight and falling number of the grain, reducing the milling yield and the baking quality. Latest breeding efforts have resulted in the development of HWW varieties that are not only tolerant to sprouting damage, but these varieties also possess very desirable agronomic and end use characteristics. Despite the relatively small volume produced, there have been some exports of U.S. HWW in recent years although exports have not followed an upward trend. Taiwan and Mexico have bought U.S. HWW on a regular basis since 2003/04 (table I-2)

Because of the light color of the bran, HWW has a higher flour extraction rate which results in flour with a higher fiber and protein content when compared to other wheat classes. Flours from HWW possess higher protein content and higher fiber content as compared to flours from HRW, making HWW flours more desirable for the production of food products such as bread and tortillas with a higher nutritional value (Wang et al 2007).

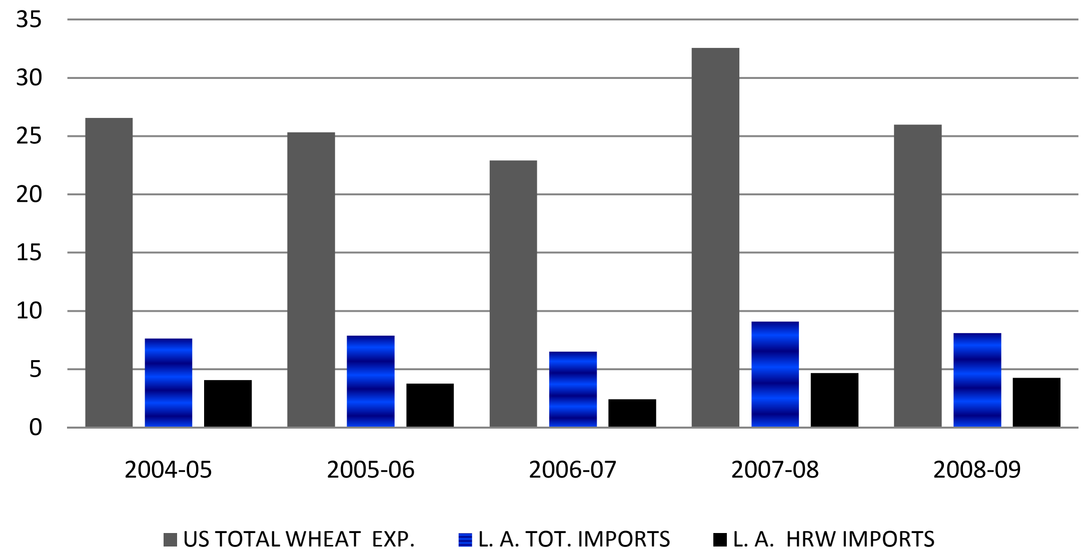
Despite potential product advantages, currently HWW is still produced in the U.S. at the specialty level, and carries premium prices which help offset the higher marketing costs of segregating HWW from HRW. However, once HWW is produced beyond the specialty level, marketing costs will drop because of larger volumes and the economies of scale.

Table I-2. U.S. Hard White Wheat Exports 2003/04 - 2007/08 (1,000 bushels)

Country	2003/04	2004/05	2005/06	2006/07	2007/08
Yemen	-	-	-	-	3,222
China Taiwan	450	213	417	703	1,315
Mexico	178	1,307	393	804	4
Egypt	1,374	-	-	-	-
Philippines	34	7	342	-	-
South Africa	1,324	-	2,006	-	-
Venezuela	234	-	-	-	-
Other countries	1,140	438	-	78	371
Total	**7,173**	**1,965**	**3,968**	**1,585**	**4,912**

Source: USDA/FAS

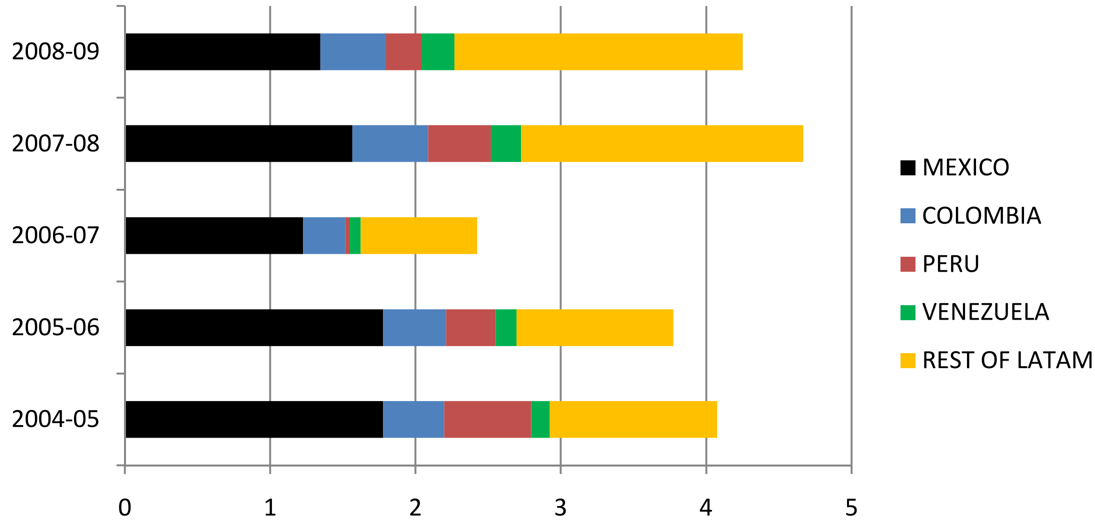
In the last five marketing years 2004/05 to 2008/09, Latin America purchased on average 28 % of the total U.S. wheat exports, 48 % of which were HRW (figure I-2). The markets in Mexico, Colombia, Peru and Venezuela accounted for a significant part of the total exports of U.S. HRW to Latin America in recent years (figure I-3). Canada also supplies HWW to the Latin American market with some sales of Canadian Western Hard White Spring (CWHWS) to Puerto Rico, Mexico, Guyana and Brazil. Because of its potential advantages, wheat millers, bakers, and final consumers may prefer HWW over the traditional HRW (Lin and Vocke 2004). Given the importance of Latin America as a major destination for U.S. wheat exports, it is important to understand how Latin American wheat millers perceive and value U.S. HWW relative to other sources of hard wheat available in the market.



Source: U.S. Wheat Associates.

Figure I-2. Volume of U.S. Total Wheat Exports to Latin America (Million Metric Tons)

A price incentive will be needed to stimulate HWW production in the short term, and to cover the added costs associated with segregation, and agronomic risk (Ransom et al 2006). Therefore, it is important to establish if millers in Latin America are willing to pay a price premium to buy U.S. HWW. This information is expected to help producer and grower associations in their planning with regards future plantings and commercialization of HWW. Wheat breeding programs are also expected to benefit from this information because they can enhance the value of U.S. hard wheat to the millers in Latin America. In this light, the purpose of this study is to generate information on millers' demand for HWW from the U.S. as compared to other types of hard wheat from other sources. This understanding is expected to help policy makers and marketers in the U.S. in the design of effective marketing and production programs for U.S. wheat.



Source: U.S. Wheat Associates.

Figure I-3. U.S. HRW Wheat Exports Distribution in Latin America (Million Metric Tons)

This study is expected to contribute to the growing literature regarding wheat markets, by using the Self Explicated Method (SEM) to elicit milling companies' preferences. The method used in this study is easy to implement, and it can handle a numerous set of attribute and attribute levels, reducing the risk of subject fatigue which often leads to biased answers.

Objectives

The overall objective of this study is to determine wheat millers' demand for hard wheat attributes in selected Latin American countries.

The specific objectives are:

1. To determine wheat millers willingness to pay (WTP) for U.S. HWW and U.S. HRW in selected Latin American countries.
2. To determine millers relative WTP for hard wheat attributes such as class of wheat, test weight, falling number, protein content, stability, P/L ratio and W value, in selected Latin American countries.
3. To determine constraints, other than monetary, for the sourcing of U.S. HWW by millers in selected Latin American countries.

CHAPTER II

REVIEW OF LITERATURE

Background about HWW in the U.S.

Hard white wheat is not a new crop; it was introduced in the U.S. during the late 1960’s from Australia by Dr. Elmer G. Heyne, who was then the leader of the wheat breeding project at Kansas State University. It was found that HWW had several desirable end use characteristics when compared to HRW; however, it had to overcome several obstacles to start commercial production. One of the biggest obstacles was the susceptibility of the grain to sprout before harvest. Fortunately advances in the breeding programs have led to varieties that are not just resistant to sprout damage, but also these new varieties possess agronomic and end-use characteristics that are as good as or better than commercial HRW varieties. A previous study by Pike and Mac Ritchie (1994) found that the mean protein composition, development time and bake test loaf volume of the new HWW varieties were as good as the then existing HRW varieties which were grown at the Kansas State University‘s Agricultural Research Center.

Another important issue is the marketing of a new class in a system dominated by HRW. Marketing constraints include storage capacity limitations and additional operational costs. More specifically, the receiving capacity of many grain elevators is not large enough to handle both classes of wheat simultaneously, which could limit the future expansion of HWW. Also, segregating wheat by class implies additional operational costs at the elevator level, which is reflected in higher prices to the buyers. Herrman et al (1999) found that the additional costs per bushel for segregating wheat by quality using a near infrared transmission (NIRT) whole grain analyzer, and a Single Kernel Characterization System (SKSC) for grain elevators with one drive, two bucket elevators and two pits were from $ 0.0225 for two quality levels to $ 0.0248 for three quality levels, while the segregation costs for elevators with two drives, two bucket elevators and three pits were from $ 0.0188 for two quality levels to $ 0.0193 for three quality levels at a operating efficiency of 90 percent. Results of this study suggest that if HWW represents 30% of the total wheat received during harvest, the added costs of handling both HRW and HWW should be less than $0.02 per bushel.

In the short run economic incentives are needed to encourage growers to produce HWW. To encourage the production of white wheat, the Farm Security and Rural Investment Act of 2002 included the Hard White Wheat Incentive Program, which allocated $ 20 million as incentive payments to producers of HWW. Because of this program, the number of acres of HWW planted increased from approximately 250,000 in 2001 to 330,000 acres in 2002 (Taylor et al 2005). However, despite government incentives in the past, the production of HWW in the last years has not followed a consistent upward trend, and HRW continues to be by far the dominant wheat class grown (table II-1).

Table II-1. US Hard Winter Wheat, Total Production 2005-2009 (1,000 Bushels)

Year	HRW	HWW
2009	919,015	18,128
2008	1,034,694	22,702
2007	955,555	21,454
2006	682,079	13,284
2005	929,820	25,279

Source: NASS, USDA

Eberle et al (2004) found that the greatest obstacle for the future expansion of HWW for producers of both types of hard wheat were the extra activities, and costs involved in segregating HWW from HRW as these producers will not stop producing HRW completely, while for the traditional HRW producers the biggest obstacles were the absence of a monetary incentive such as price a premium for HWW and the lack of productivity data over time were to compare HWW with HRW yields.

Additionally, the 2008 Farm Act created a HWW development program which seeks to incentivize the U.S. production of HWW. Through this Act, payments of at least 20 cents per bushel of HWW produced and no more than $ 2.00 per acre planted of HWW with eligible seed, are the economic incentives offered to encourage the production of at least 240 million bushels of HWW by 2012 (ERS USDA 2008). Unfortunately in the short run, the response to the program has not been as expected, as during the last two crop years, no more than 10 percent of the total hard winter wheat production in major producing states has come from HWW (table II-2).

Cost savings by the flour mills, which occurs as a result of the higher milling yield of HWW varieties, may provide an estimate of the price premiums HWW can command. Using data from the Wheat Marketing Center at Portland, Oregon, Boland and

Dhuyvetter (2002) estimated that the average flour milling cost, defined as the cost to produce 100 pounds of flour was $ 8.27/cwt for the HWW varieties being tested in Colorado, Kansas and Nebraska from 1999 to 2001, compared to $ 8.77/cwt for the average of the HRW varieties exported by the Gulf port, for the same years.

Table II-2. US Winter Wheat Production and Distribution by State that grow both HRW and HWW, 2008-2009 (percentage of total production)

State	Hard Red		Hard White		Other Classes	
	2008	2009	2008	2009	2008	2009
Arizona	95	85	5	5	0	10
California	83	77	7	10	10	13
Colorado	93	93	7	7	0	0
Idaho	29	28	1	1	70	71
Kansas	97	98	3	2	0	0
Montana	99	100	1	0	0	0
Nebraska	99	99	1	1	0	0
Oklahoma	97	99	2	0	1	1

Source: NASS, USDA.

Higher whole white wheat flour price increases baker's manufacturing costs by $0.01 to $0.015 per loaf of bread or package of tortillas compared to HRW flour. However, the reduced quantities of sweeteners and dough additives used to manufacture food products made from whole white wheat flour often offset the higher cost of sourcing this type of wheat (Brester et al 1995).

In summary, because of the higher extraction rate, lighter color and less bitter after taste, HWW is a suitable option for the production of specialty products, particularly in the U.S. market where buyers often pay price premiums of about 10 cents per bushel of HWW (Taylor 2003).

Methods used to estimate consumer willingness to pay

Companies and producer associations are interested in the market response of new products and services. Therefore, market research plays a critical role in evaluating the acceptance and viability of new offerings to the market. Valid estimates of the Willingness to Pay (WTP) are essential to develop an optimal pricing strategy that increases the profitability of the products offered, forecast market response to price changes, and estimate market demand for new products. Willingness to pay is defined as the maximum amount of money that when paid by an individual, makes him indifferent to improving the quality of the good or service and maintaining the status quo quality (Lusk and Hudson 2004).

There are several approaches available to measure willingness to pay; each approach has its own conceptual foundations and methodological implications. To get estimates of WTP for food attributes, previous studies have used Contingent Valuation (CV), Conjoint Analysis (CA), Choice Experiments (CE), Experimental Auctions (EA) , Self Explicated Method (SEM), or a combination of these methods (Lusk 2003; Lusk and Norwood 2008; McCluskey et al 2007)

Conjoint analysis is a popular method to measure consumer's preferences; several researchers have used this technique to study consumer's choices for food products (Hu, Woods and Bastin 2009; Carlsson, Frykblom and Lagerkvist 2007). Traditional conjoint analysis use full profile descriptions which are a systematic variation of product attributes using an experimental design. The number of profiles created is a combination of a product attribute and attribute levels. Conjoint Analysis assumes that all product options are traded off against each other; however Lussier and Olshavsky (1979) have found that choice process by consumers can be described as a two- stage strategy, where first a conjunctive strategy is used to eliminate unacceptable alternatives, and then a compensatory strategy is used to evaluate the remaining alternatives.

The Self Explicated Method (SEM) is another approach to consumer preference measurement, it is based on the conjunctive-compensatory decision model, where choice among multi-attribute products is modeled as a two- stage strategy. The first stage is a conjunctive process in which products with one or more totally unacceptable levels within a particular attribute will be eliminated. Finally, in the second stage a compensatory process is used, in this stage consumers trade-off the remaining products based on the acceptable attribute(s) and attribute levels (Srinivasan 1988). Because of theoretical considerations, Conjoint Analysis appears to be superior in validity over the less complex and cheaper technique such as Self Explicated Method (Leigh, Mackay and Summers 1984). Nevertheless, the presumed superiority has not been found in empirical studies comparing the two methodologies (Green and Srinivasan 1990; Srinivasan and Park 1997). Moreover, there are several advantages of the Self Explicated Method over Conjoint Analysis, the SEM is easier to administrate and the task complexity is notoriously lower (Akaah and Korgaonkar 1983). When a large number of attributes is in a full profile conjoint analysis, respondents are overwhelmed by the excess of information which may result in simplifying behavior of the respondent. This behavior introduces bias in the estimates from the conjoint analysis (Wright 1975).

In contrast to the full profile Conjoint Analysis, a larger number of attributes can be handled easily in the Self Explicated Method (Srinivasan and Park 1997). Data collection and analysis are also comparatively easier in the SEM. Additionally, the design of the stimuli in the conjoint analysis is quite complex and often requires the specification of an experimental design. In terms of reliability, the Self Explicated Method shows better results than the Conjoint Analysis or at the most no significant differences between the two approaches are found. (Heler, Okechuku and Reid 1979; Green, Krieger and Agarwal 1993; Leigh, Mackay and Summers 1984). Green, Krieger and Agarwal (1993) compared a type of hybrid conjoint analysis known as Adaptative Conjoint Analysis (ACA) to the SEM. Their findings show that there was not a significant difference in terms of reliability between the two methodologies.

Previous studies on WTP for grains.

Several studies have evaluated consumer willingness to pay for food quality attributes in the grain industry. De Groote and Kimenjo (2008) estimated WTP for yellow maize bio-fortified with pro-vitamin A for urban consumers in Nairobi Kenya, using a semi-double-bounded logistic model. When yellow and white maize are at the same price, most of the consumers will prefer white maize; consumers need on average a price discount of 37 % to buy yellow maize.

Onyango, Nayga and Govindasamy (2006) analyzed consumer tradeoffs between for different labeling statements for GM cornflakes in the U.S. using a choice model. Their study shows that consumer’s choice for labeled GM cornflakes is influenced by the type of information presented in the label, specifically information linked to certification and benefits has a positive impact on consumer’s willingness to pay.

Peterson and Yoshida (2004) studied attitudes of Japanese consumers towards domestic and foreign varieties of rice. Their findings suggest that retail prices for imported rice are higher than the average consumer WTP, while most domestic rice was priced below WTP. For rice imported from the US, negative perceptions of flavor rather than concerns about food safety influenced the WTP.

Anand, Mittelhammer and McCluskey (2007) investigated the effect of consumer information and product benefit related to GM food in India. When producer friendly information about reduced herbicide and production costs was provided, WTP for GM wheat increased only by a small amount. Moreover, this study shows that consumers were not willing to pay a significant premium for the public benefits of reduced herbicide and low production costs.

Several studies have been conducted to measure the implicit value of wheat quality attributes to wheat buyers. These studies have evaluated the effect of the different FGIS grades and protein on prices in several markets (Wilson 1989; Uri et al 1994; Ahmadi-Esfani and Stanmore 1994). The data used in these studies are referred to as revealed preference data and it represents actual transactions make in real markets.

However, when there is no market data about the market valuation of wheat end-use quality attributes, survey based methods are used to obtain the data needed to estimate price-response functions. The data used in this type of studies, is referred to as stated preference data. Gallardo et al. (2009) used an innovative combination of conjoint analysis to evaluate Mexican millers' preferences for HRW quality attributes. In this study the variability in the attribute level was introduced by using the mean-variance approach and negative exponential functional form. The results of this study shows that the mean-variance approach yielded a higher level of external validity, also the Mexican milling companies are willing-to-pay the most for a marginal change in (P/L) ratio, protein content, and test weight respectively.

One of the first empirical uses of the Self Explicated Method was in a job choosing setting. Srinivasan (1988) compared the predictive validity of the Conjoint Analysis versus the SEM for MBA students choosing among job offers. It was found that the Self Explicated Method yielded a slightly larger predictive validity when compared to the more complicated Conjoint Analysis method.

This study uses the Self Explicated Method to measure the WTP for U.S. HWW in selected Latin American countries. There have not been many applications of the self explicated approach to elicit consumer preferences in the food industry. One of the most recent applications involved the use of hybrid methods. Lusk and Norwood (2008) introduced a hybrid method to determine consumer's preferences for eggs and pork produced by different production systems in three U.S. cities. The method is referred as Calibrated Auction Conjoint Analysis, it combines the strengths of both auction bids and the self explicated approach. Their results suggest that consumers place higher values and therefore are willing to pay more to buy products from production systems with the highest animal welfare practices.

Our study proposes the application of the Self Explicated Method which is a simpler and yet less costly method. It has been found in the literature to be reliable in eliciting consumer preferences for multi-attribute goods, while reducing the information overload in the respondent.

CHAPTER III

CONCEPTUAL FRAMEWORK

Lancaster (1966) stated that a good is composed of more than one attribute, and the utility to the consumer comes from the attributes the good possesses by itself. Ladd and Martin (1976) applying the product characteristics approach to production inputs suggest that the demand for an input is related by the input's characteristics and the price of an input is the total monetary value of the input's attributes.

Under this framework, in this study, the utility that millers derive from purchasing hard wheat is described as:

Miller's Utility for Hard Wheat= f (Product attributes, Price of Product)

Wheat attributes included in the present study are: class of wheat, test weight, protein content, falling number, stability time, P/L ratio, W value, and price. Because the U.S. HWW possesses several milling and nutritional advantages over U.S. HRW, it is hypothesized that US HWW will be more valuable for wheat millers. In other words, the fist hypothesis that is tested in this study is that U.S. HWW provides more utility to the Latin American millers than U.S. HRW does.

Test weight is one of the grading factors determined by the Federal Grain Inspection Service (FGIS). It is a measure of density of a wheat sample, it is also a proxy for milling yield. Therefore wheat with higher test weight values is more valuable to the millers.

Falling number measures the level of alpha-amylase activity which provides information about sprout damage. High alpha amylase activity or low values of the falling number indicate sprout damaged wheat, resulting in flours with poor color and weak structure (Wheat Marketing Center 2008). A positive relationship between wheat falling number and miller's utility is expected.

Protein content is the percentage of protein by weight in a sample. It is a key specification for wheat and flour buyers because protein content relates to many processing properties such as water absorption and gluten strength. For bakers, flours with higher protein content, usually requires more water and a longer mixing time to achieve optimum dough consistency. Higher protein content is desired for products with a chewy texture such as pan breads (Wheat Marketing Center 2008). Therefore is expected that milling companies will have a strong preference for wheat with higher values of protein content.

The farinograph test is one of the commonly used flour quality tests. Test results include absorption, arrival time, stability time, peak time, departure time, and mixing tolerance index. In this study we focus on stability time which indicates gluten and dough properties, long stability times imply strong gluten and dough properties which are highly desirable to the production of bread. Stability time values are also useful for predicting finished product texture characteristics. For example, strong dough mixing properties are related to firm product texture (Wheat Marketing Center 2008). For this reason, higher stability time values are supposed to provide more utility to the millers.

There are several instruments commonly used when evaluating dough stretch. The alveograph is particularly advantageous for this purpose because it expands the dough in all directions which is called biaxial extension. By doing so, it equates well with the gas cell expansion in rising dough. In other words the deformation process during the alveograph test resembles the deformation that occurs during dough fermentation or oven rise (Faridi and Rasper 1987). This test is helpful to determine the gluten strength of dough. The results include P value, L value and W value. P values are indicators of gluten strength; low P values indicate weak gluten flour and vice versa, higher P values or dough with strong gluten are preferred for breads. L values measure the dough extensibility which is the dough's ability to stretch before breaking. P/L ratio measures the relationship between dough strength and dough extensibility. The W value measures the amount of energy needed to inflate the dough to the point of rupture and indicate dough strength. It is a combination of dough strength and extensibility (U.S. Wheat Associates 2009). The type of wheat which their flours produce higher P and W values during the alveograph test, are expected to be more valuable for milling companies.

The last attribute considered is price, according to the law of demand there is an inverse relationship between the quantity demanded and price.

CHAPTER IV

METHODOLOGY

This chapter describes the methods and procedures used to determine Mexican and Peruvian millers' preferences for U.S. Hard White Wheat. This section details the data collection method and the data analysis approach used to estimate millers' WTP for U.S. HWW in Mexico and Peru.

Data collection method

The Self Explicated Method was administered through an e-mail survey in the Spanish language, designed to be answered by the grain purchasing manager of the milling company in Mexico and Peru. The survey had two sections; the first section consisted of eight questions where the Self Explicated Method was implemented. The second section of the survey consisted of ten questions, the objective of this second section was to collect information related to potential constraints for the acquisition of U.S. HWW, end users of the flour marketed by the milling companies, choices of wheat classes and quantities purchased in the previous year, market outlook for the production of flours with higher fiber content, ash level content in the flour sold, and installed milling capacity.

Survey design

Review of the relevant literature was conducted and experts in the field of breeding, marketing and processing of wheat were consulted in order to identify the appropriate attributes and attribute levels to be included in the survey. The selected attributes were class of wheat, test weight, falling number, protein content, stability time, alveograph P/L ratio, alveograph W value, and price. Before sending the final version of the survey, a pre-test was conducted in Mexico, where technical personnel from the Mexican millers' association (CANIMOLT) provided valuable feedback on the improvement of the survey.

The number of attribute and attribute levels used in the present study are shown in the table IV-1. The first attribute, class of wheat consisted of three levels U.S. HRW, U.S. HWW, and CWHSW. Test weight varied six levels from 70 to 82.5 Kg/hl. Protein content was varied by seven levels, from 8 to 14 percent. Falling number consisted of ten levels, from 230 to 410 seconds. Stability included seven levels, from 3 to 21 minutes. Alveograph P/L ratio was varied by eight levels, from 0.40 to 1.80. Alveograph W included eight levels, from 180 to 320 (10^{-4} Joules), and the final attribute was price which was varied by five levels from $210/MT to $250/MT.

The range of the assigned levels to each attribute was varied by even wider ranges than those usually found in the Crop Quality reports published by U.S. Wheat Associates. The reason for this, is to establish which level(s) within a particular attribute out of the customarily reported are still acceptable for the purchasing managers of the wheat milling companies.

Table IV-1 Attribute and attribute levels used in the survey.

Attributes	Attribute Levels									
	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Level 9	Level 10
Wheat class	US HRW	US HWW	CWHWS							
Test Weight (Kg/hl)	70	72.5	75	77.5	80.0	82.5				
Protein content (%)	8	9	10	11	12	13	14			
Falling number (Seconds)	230	250	270	290	310	330	350	370	390	410
Stability (Min)	3	6	9	12	15	18	21			
Alveograph P/L	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8		
Alveograph W (10^{-4} Joules)	180	200	220	240	260	280	300	320		
Price USD/MT	210	220	230	240	250					

Because the Self Explicated Method is a multi attribute approach to estimate consumer preferences based on attribute importance and attribute desirability and it does not involve any type of econometric analysis, correlation between attributes is not an issue. An example of a question used in this study is presented in figure IV-1. The final version of survey is presented in the Appendix B.

1. Assume you are about to purchase wheat for your company. In the following table, first you are asked to identify if there is any test weight level that is *totally unacceptable* (n/a) to you (you won't buy it). Then, for the remaining levels you will rate on a scale of 0 to 10, how desirable each **test weight** level is to your milling needs.

Level	**Test Weight (Kg/hl)**	**Circle the number of how desirable each attribute level is: n/a= Unacceptable 0= Extremely undesirable 5= Neutral 10= Extremely desirable**											
1	70	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2	72.5	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
3	75.0	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
4	77.5	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
5	80.0	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Figure IV-1. Example of a survey question using the Self Explicated Method.

The survey was conducted among the purchasing managers of wheat milling companies in Mexico and Peru. The Mexican millers' association (CANIMOLT) distributed the survey to their associates by e-mail. In total, there were nine milling companies in Mexico which participated in the survey for this study. In Peru, the

National Society of Industries (SNI) provided a list and contact information of the associated wheat millers. In total, two out of eight Peruvian wheat millers participated in our survey. Although the number of respondents might look relatively small in terms of the total population, the respondents represented milling companies that are significant players in the importing countries. In other words, because of their size, these companies are representative of the milling industry in their home countries. More specifically, in Mexico, the nine millers represent 63.35 percent of the total installed milling capacity. The two millers surveyed in Peru represent 63.9 percent of the total installed milling capacity.

Steps to Collect the Data.

At the beginning of the survey, the participants were informed about the purpose and objectives of the study. In an introductory statement, it was emphasized that participation in the survey was completely voluntary, they had no obligation to fill out the survey, and they could decline to complete the survey at any time with no penalty. Subjects were informed that the information regarding the respondent and their companies disclosed to the researchers will be kept confidential and anonymous; discussion of results will be at the aggregate level, with no individual company being named.

As it was previously disclosed, the survey consisted of two sections. In the first section we administered the Self Explicated Method (SEM), the procedure used for data collection in this section follows closely the methodology used by Srinivasan and Park (1997):

1. The respondent is informed about an attribute and the levels within the respective attribute; at this point the respondent is asked to identify any level(s) that is (are) completely unacceptable. A wheat option with a completely unacceptable level will not be chosen no matter how attractive the option is in other attributes.
2. From the remaining and acceptable levels, the respondent will determine the most preferred and least preferred levels; with the desirability ratings being set at 10 and at 0 respectively. The self explicated method asks the respondent to evaluate the desirability of each attribute level directly. The desirability ratings (0-10) for other acceptable levels are obtained.
3. Finally, the respondent is asked to indicate the relative importance of each one of the attributes previously evaluated, the respondent is asked to allocate 100 points among the attributes.

In the second section of the survey we were interested in getting basic information about the millers such as installed milling capacity, types of wheat purchased, end use of the flour sold, type and percentage of flours produced, outlook for the production of whole wheat flour, millers' perceptions about US HWW, and finally, factors that could prevent milling companies in Mexico and Peru from buying U.S. HWW.

Data analysis

The desirability ratings are in a scale where the most preferred attribute level within an attribute receives a rating of 10, and the least preferred level within an attribute receives a rating of 0. Let D_{ijk} be the scaled desirability rating (on a scale from 0 to 10) given by respondent i, for level k (k=1, 2, …,k) of attribute j (j=1,2,…,8).

The subscript I_{ij} denote the relative importance rating given by respondent *i* (*i*=1,2,….,n) (where n=9 for Mexico, and n=2 for Peru), for attribute *j* (*j*=1,2,…,8). The attribute importance for each respondent *i* will sum to 100 across attributes (That is $\sum_{j=1}^{8} I_{ij} = 100$).

The self-explicated part- worth for the acceptable attribute levels are obtained by multiplying the importance ratings with the desirability ratings normalized by its scale:

(1) $P_{ijk} = I_{ij} (D_{ijk} /10)$,

Where

P_{ijk} = respondent *i's* self-explicated part-worth for attribute *j's* k_{th} level.

I_{ij} = respondent *i's* importance for attribute *j*.

D_{ijk} = respondent *i*'s scaled desirability rating (from zero to ten) for attribute *j's* k_{th} level.

The part-worth function of an attribute provides the utility or worth of different levels of that attribute. By the additive assumption, the overall utility for the product is the sum of the part-worths for the product levels on the different attributes.

At this point the data available allow calculating each miller' attribute based utility for a particular type of wheat. The miller' utility for a particular option can be calculated by multiplying the relative importance of each attribute by attribute's rating. The individual *i's* utility for a wheat option *j* can be formulated as:

(2) $$U_{ij} = \sum_{k=1}^{8} \sum_{l=1}^{lk} W_{kl} * (P_{ijk} - \sum_{l=1}^{8} P_{ijk} / L_k)$$

Where L_k is the number of attributes over which the k^{th} attribute is varied and W_{kl} is a dummy variable that takes the value of one if the hard wheat alternative posses the l^{th}

level of the k^{th} attribute, and zero otherwise. The term $I_{ij}\ (D_{ijk}/10)$ is the self explicated part-worth. This product is the utility provided from the l^{th} level of the k^{th} attribute. After calculating the Self Explicated part-worths, they are normalized (N (Pijk) subtracting from each part-worth the term $\sum_{l=1}^{8} P_{ijk} / L_k$, which is the mean level of all part- worths for attribute *k*. By subtracting this term we force the part- worths within each attribute to sum zero. To determine the preferences at the population level, we simply calculate the average of the normalized part-worth of each attribute level previously calculated by each survey respondent.

Willingness-to-pay estimates can be derived from the Self Explicated Method. First we proceed to calculate the marginal willingness-to-pay (MWTP) which is defined as the amount of money an individual would have to give up to be indifferent between towards a one unit increase in the attribute.

To get this value, first we calculate for each individual the utility differences between the normalized part-worth $\mathbf{N}(\boldsymbol{P_{ijk}})$ of the highest "acceptable" minus the lowest " acceptable" level of attribute *j* , and then divide this by the difference between the highest minus the lowest "acceptable" levels of the respective attribute.

$$(3)\quad \text{Slope of attribute } j = \frac{\mathbf{N}(\boldsymbol{P_{ijk}}) \text{ highest level attr. } j\text{-}th - \mathbf{N}(\boldsymbol{P_{ijk}}) \text{ lowest level attr. } j\text{-}th}{\text{Highest level attribute } j\text{-}th - \text{Lowest level attribute } j\text{-}th}$$

The marginal willingness to pay (MWTP) for one unit increase in the attribute *j-th*, is calculated as the value of the slope of the attribute *j-th* divided by the value of the slope for the price attribute.

(4) MWTP= Slope attribute *j-th* / (-1*(Slope of price))

As an example the data needed to calculate the marginal willingness-to pay for *j* = test weight, for respondent *i-th* is shown in table IV-2.

Table IV-2. Example of data used to calculate the Marginal Willingness to Pay

Test weight	Rating	$\frac{D_{ijk}}{10}$	I_{ij}	P_{ijk}	$N(P_{ijk})$	Price	Rating	$\frac{D_{ijk}}{10}$	I_{ij}	P_{ijk}	$N(P_{ijk})$
75	6	0	15	0	-8.437	210	10	1	20	20	10
77.5	8	0.5	15	7.5	-0.937	220	8	0.75	20	15	5
80	9	0.75	15	11.25	2.812	230	6	0.5	20	10	0
82.5	10	1.0	15	15.0	6.562	240	4	0.25	20	5	-5
						250	2	0		0	-10
Diff =7.5						Diff =40					

Source: Survey data

Slope of test weight for the *i-th* respondent= (6.562-(-8.437))/7.5= 2.00

Slope of price for the *i-th* respondent= (-10-(10))/40= -0.50

MWTP for test weight *i-th* respondent = (2.00)/-1*(0.5) = 4.00

Thus, for this particular respondent the willingness to pay for a one –unit increase in test weight is $4.00/MT

To calculate the marginal WTP (MWTP) for U.S. HWW versus U.S. HRW we subtract the normalized part-worth **N(*P_{ijk}*)** of U.S. HWW minus the normalized part-worth **N(*P_{ijk}*)** of U.S. HRW and divide this value by the value of the slope of price for that particular respondent *i-th*. The MWTP for US HWW versus US HRW is given by:

$$MWTP_{\text{US HWW-US HRW}} = \frac{\mathbf{N}(\boldsymbol{P_{ijk}})\text{ US HWW- }\mathbf{N}(\boldsymbol{P_{ijk}})\text{ US HRW}}{\text{Slope of price respondent } i\text{-}th}$$

The WTP estimates to move from a low to a high level of each attribute are calculated by multiplying the MWTP by the difference between the high and low acceptable levels of each attribute.

From the second part of the survey, the question 10 asked the millers about factors that would prevent them from buying U.S. HWW. This question consisted of four items, respondents were asked to rate each item from 1(not important) to 5 (very important), according to the strength of their personal preference. After subjects rated the importance of each item to them, an N*K (subject by item) matrix of information is generated. The analyses performed on the data include the mean and standard deviation for each item.

CHAPTER V

RESULTS AND DISCUSSION

The Self Explicated Method was used to elicit wheat millers' preferences in selected Latin American counties. Overall 11 wheat millers from Mexico (9) and Peru (2) participated in this study. Mexico and Peru are among the largest buyers of U.S. HRW in Latin America, these two countries accounted for 40.08 and 8.57 %, respectively of the U.S. HRW exports to Latin America during the marketing years 2004/05 to 2008/09

General Characteristics of the Millers Surveyed

The wheat purchasing managers that responded to the survey for this study represent milling companies that account for a significant proportion of the total milling capacity in Mexico and Peru. According to CANIMOLT, the total milling capacity in Mexico is 24,848 MT/day, the milling capacity of the 9 milling companies surveyed is 15,750 MT/day. Hence our survey participants represent 63.35 % of the total milling capacity in Mexico. In Peru, as of 2007 the wheat milling committee of National Society of Industries (SNI) estimated that the total milling capacity was 2,135,000 MT/ year.

The milling capacity of the 2 Peruvian companies surveyed is 1,364,552 TM/ year, representing 63.9 % of the total milling capacity in Peru. Although the sample size may look small in terms of the number of respondents, the measured preferences come from a significant portion of the wheat milling industry in these two countries. One factor that influenced the number of responses might be the method of survey delivery. The surveys were sent by e-mail, and even though we counted on the assistance of CANIMOLT to distribute the survey to the Mexican millers, and after repeated attempts to get more answers from the Peruvian millers, the response rate was 19 and 25 % for Mexico and Peru, respectively. The response rate for the e-mail surveys in this study seems to be low; however it is within the range previous researchers have found for this particular survey delivery method. Kaplowitz et al (2004) studied the response rate for several methods of survey delivery. They found that e-mail surveys had a response rate of 20.7 percent which was the lowest among all the survey delivery methods evaluated.

In order to meet customers' needs, milling companies often source different kinds of wheat that they plan to blend, in order to offer an optimal product. Table V-1 reports the wheat classes which were purchased for the milling companies surveyed in Mexico and Peru during 2008.

Table V-1. Wheat purchases by the surveyed milling companies in Mexico and Peru, by type of wheat during 2008 (percentage of wheat purchased)

Class of Wheat	Mexico % of wheat purchased	Peru % of wheat purchased
US HRW	39.65	9.5
US HRS	14.19	-
US SRW	23.13	3.6
CWRS	17.99	63.14
National	5.04	
Argentinean		16.29
European		7.47

Source: survey data.

The U.S. supplied about 75 % of the total wheat needed for the Mexican milling companies included in this study. Hard wheat which is imported from Canada and U.S. (U.S. HWW, U.S. HRS and CWRS) represented about 71 % of the total wheat purchased. The remaining 29 % corresponds to soft wheat (U.S. SRW and National). The situation is completely different in Peru where Canadian Western Red Spring (CWRS) accounts for about 63 % of the total wheat imported, followed by Argentinean wheat and U.S. wheat. Hard wheat (U.S. HRW and CWRS) represented 72.64 % of the total wheat imported during 2008. Canada and Argentina have successfully eroded U.S. wheat export market share in Peru in the last few years (U.S. Wheat Associates). The U.S. wheat market share in Peru is not expected to increase in the near future. Argentina is a natural supplier to Peruvian millers because both Peru and Argentina are members of Mercosur (Southern common market agreement), and Argentina can export wheat to all Mercosur countries at very low or zero duty. Additionally, the Canada-Peru Free Trade Agreement entered into force on August1, 2009 (Foreign Affairs and International Trade Canada) which gives Canadian wheat a competitive advantage over US wheat in the Peruvian market.

Milling companies produce several types of flour suitable for different end uses. Table V-2 lists the end major users of the flour sold by the companies included in this study. The survey results show that in Mexico bread making use accounts for about 70 % of the total flour produced by the milling companies. The production of pasta products is the smallest segment for the milling companies considered. Production of crackers which are made with flour from flour made of soft wheat (low protein content) represented about 11% of the end users of the flour produced. There are clear differences in terms of the size of the end use segments for the flour sold by the surveyed millers in both

Table V-2. End use of the wheat flours produced in Mexico and Peru 2008

End use	Mexico %	Peru %
Bread	70.7	61.67
Pasta	0.3	13.33
Tortilla	11.2	-
Crackers	11.6	12.34
Other uses	6.2	12.65

Source: survey data.

countries. More specifically, flour to produce bread represents 61.6 % of the flour milled in Peru. Next in importance are pasta products which are widely preferred over tortillas in South American countries. Bread and pasta products are the main end uses in the Peruvian market, these two segments consume 75 % of the wheat milled by the companies surveyed. Moreover, the percentage of flour destined to bake crackers is slightly higher in Peru than in Mexico. It is important to clarify that the figures in table V-2 apply to the millers who responded the survey. On terms of volume traded, the Mexican market is by far larger than the Peruvian market.

In order to gain an insight about the production of whole wheat flours, we asked the millers if they produce both regular (free of wheat' bran) and whole wheat flours or not and, if so, what percentage of the total production corresponds to whole wheat flour. The answers are summarized in table V-3.

In Mexico, most of the milling companies surveyed sell both types of wheat flour. However a small percentage of the total flour production comes from whole wheat flour. As table V-3 shows, for most of the surveyed companies, the production of whole wheat flour does not surpass 2 % of the total production. As expressed by the Executive director of the Mexican millers association, CANIMOLT there is a concern about providing food

Table V-3. Number of milling companies engaged in the production of whole wheat flour and percentage of whole wheat flour produced in Mexico and Peru, 2008.

Production of:	**Mexico** **# of companies**	**Peru** **# of companies**
Regular and whole wheat flour	7	2
% of total prod. whole wheat flour*:*		
Less than 1 %	3	2
About 2 %	3	
More than 2 %	1	
Regular flour only	2	-

Source: Survey data.

products with adequate nutritional values, and higher fiber content. Because of its intrinsic characteristics, U.S. HWW increases the fiber content without sacrificing the protein content. It is worth noting that the production of bread and tortillas account for 81.9% of the total wheat flour marketed by the Mexican milling companies surveyed and, therefore there is a tremendous potential market for U.S. HWW. The production of whole wheat flour in Peru is still at an incipient stage. Even though the two millers surveyed produce this type of wheat, it is less than 1 % of the total flour produced.

One of the key advantages of U.S. HWW is that its bran can be milled which results in flour with higher fiber content. The future prospects for the production of whole wheat flour are one of the drivers for the future demand for U.S. HWW. Therefore in the survey, we asked the millers' about their outlook for the production of this particular type of flour in the near future (next two years). Results are shown in table V-4.

Table V-4. Milling companies outlook for the production of whole wheat flour in Mexico and Peru 2008.

Production of whole wheat flour will:	Mexico	Peru
Increase	5	2
If so what percentage:		
Up to 2 %	-	2
2 to 5 %	4	-
More than 5 %	1	-
Not increase	4	-

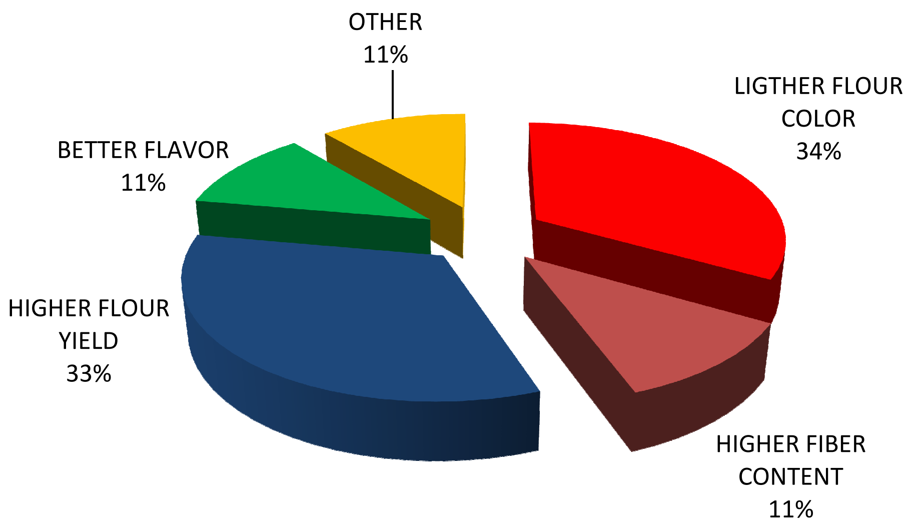
Source: Survey data.

In Mexico, five out of nine wheat purchasing managers estimate that in the near future there will be an increase in the production of whole wheat flour. Those who believe the production of this type of flour will increase were asked to quantify how much it will increase. They pointed out that between 2 to 5 % of the total production will be whole wheat flour. Overall, the production of wheat flours with higher fiber content will slightly increase in the next two years. It means that some steps are given to increase the supply of healthier food options in Mexico. The prospects for the future production of whole wheat flour in Peru are not encouraging. Millers in Peru believe that in the near future, no more than 2 % of the total flour produced will be whole wheat flour.

Perceptions about U.S. HWW

In order to design effective market penetration strategies, it is necessary to investigate the market's perception about the product to be promoted. When millers in Mexico were asked if they perceived any advantage of U.S. HWW over U.S. HRW, five out of nine answered that they do not perceive any advantage of U.S. HWW over U.S.

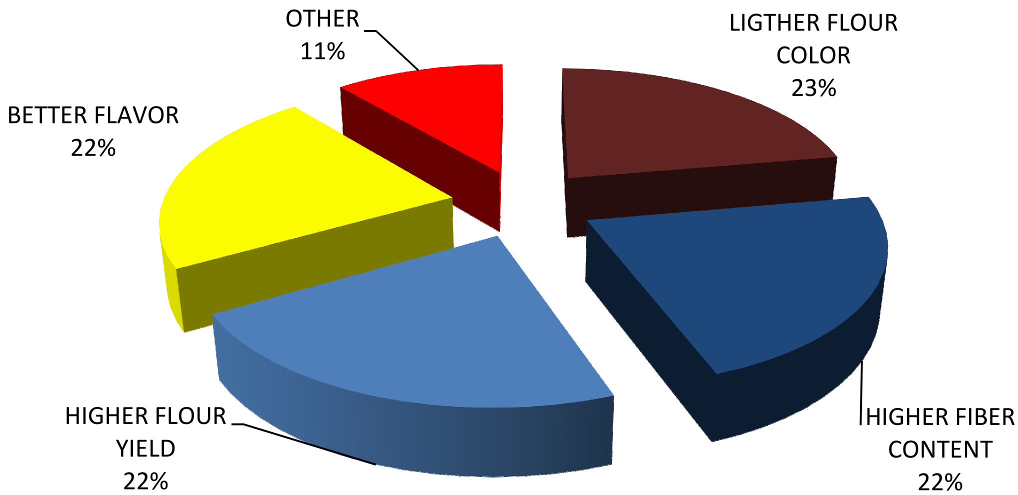
HRW. At this point it seems that the economic advantages of using U.S .HWW have not been demonstrated. For those who perceive any advantage when milling U.S. HWW, a lighter flour color and a higher milling yield were the principal characteristics associated with this class of wheat, followed for flour higher fiber content and better flavor in the final product. (Figure V-1)



Source: Survey data.

Figure V-1. Principal characteristics associated to U.S. HWW as perceived by survey respondents in Mexico

In the Peruvian market the two millers who participated in the surveys perceived U.S. HWW as having desirable processing advantages. Different from Mexico, in Peru characteristics such as lighter flour color, higher fiber content, higher flour yield, and better flavor in the final product are equally recognized (figure V-2).



Source: Survey data.

Figure V-2. Principal characteristics associated to US HWW as perceived by survey respondents in Peru.

As previously stated one of the main characteristics of milling U.S. HWW is the resulting flour with lighter color. Millers in both countries were asked if they believed that their customers would prefer flours with a lighter color. In Mexico the vast majority of millers, eight out of nine think that their customers prefer flour with a lighter color. In Peru, the two millers surveyed agreed that lighter flour will be welcomed by their customers. These results suggest that bakers and consumers place a positive valuation in bakery products made of lighter flours.

Also we wanted to know about the typical % of ash content (wet base of 14%) for the flour produced. In both countries, the ash content is typically located between 0.51 to 0.6 % (wet base of 14%) which is similar to the ash content in the flour marketed in the U.S. (0.5 to 0.6 % assuming an extraction rate of 75- 78 %). Next, millers were asked if they believe that their customers will accept any increase in the actual flour ash content.

In Mexico, 44 % of the millers stated that their customers will tolerate flours with higher ash content, while the remaining 66% of the millers stated that their customers would not be willing to accept flour with higher ash content. In contrast to the Mexican millers, the Peruvian millers surveyed unanimously answered that their customers would not accept any increase in the flour ash content. Ash is composed of non-combustible inorganic minerals that are located in the bran layer, therefore higher milling extraction rate will increase the flour ash content. It has been established that ash content has an effect on color, higher ash contents will impart a darker color to finished products (Wheat Marketing Center 2008). There is a trade-off between the higher milling yield of U.S. HWW and the maximum ash content that end users will accept.

Factors that would prevent Mexican and Peruvian millers from buying US HWW

We were also interested in establishing any factor that would prevent the milling companies from sourcing U.S. HWW. This question included four items where respondents were asked to rate each item from 1 (strongly disagree) to 5 (strongly agree) according to their personal beliefs. Results are summarized in Table V-5. Item 1 refers to miller's lack of information with U.S. HWW. In Mexico the average rating for this item, indicates that millers are not knowledgeable about this type of wheat therefore even if supply is readily available the probability of purchase is very less. In Peru, the mean value of item 1 suggests that they are more familiar with this type of wheat. Item 2 asked about the importance of U.S. HWW being supplied all year around. In Mexico the average rating for this item suggest that availability of this type of wheat all year around is important, in other words it seems that wheat purchase does not follow a seasonal pattern. In Peru millers tend to be neutral to this item. For item 3 millers were asked if the purchase of U.S. HWW will increase the storage costs to keep it separated from U.S. HRW. In Mexico the mean for this item indicates that storage costs are not an issue. In Peru the mean for this item also indicates that storage costs are not a constraint for purchasing U.S. HWW. Finally, item 4 asked if the purchase of U. S. HWW would increase production costs because of adjustments to the milling equipment. The mean for this item in both countries, suggests that the increase in the production costs is not important, in other words milling an additional type of hard wheat is not an issue.

Table V-5. Statistics of potential constraints for the purchase of U.S. HWW evaluated by Mexican and Peruvian wheat millers.

Statistics	MEXICO ITEM				PERU ITEM			
	1	2	3	4	1	2	3	4
Mean	3.778	3.778	3.111	2.333	2.667	3.333	2.667	2.000
Standard deviation	1.481	1.394	1.764	1.581	0.557	1.155	1.528	1.000

Source: Survey data.

Utility function derived from the Self Explicated Method

One of the advantages of the Self Explicated Method (SEM), is that it can be used to calculate each respondent' attribute based utility for a particular wheat option. However to gain an understanding about the representative preferences for the milling companies surveyed, we calculate a utility function that reflects the average preference of the milling companies in each country. Table V-6 reports the attribute based utility function calculated from the self explicated ratings and importance data (equation 2).

One of the hypotheses to be tested is that because of its advantages, U.S. HWW maximizes miller's utility when compared to U.S. HRW. Because the vast majority of millers in both countries did not have any knowledge about Canadian Western Hard White Spring (CWHWS), it was dropped from the analysis. It was found that the traditional U.S. HRW provides the highest utility to the milling companies surveyed in both countries. This result is consistent with the findings from the previous section of the survey, most of the milling companies in Mexico stated that they did not perceive U.S. HWW to be superior over U.S. HRW. Even though the Peruvian millers recognize the advantages of U.S. HWW in their ratings of the Self Explicated Method they still favor U.S. HRW therefore the use of this type of wheat increases their utility.

As expected, the analysis of the data from the Self Explicated Method shows that higher test weight values are associated with an increase in millers' utility. In both countries, there is a strong preference for wheat with a test weight of 82.5 (kg/hl). The largest change in utility for the millers in both countries occurred when test weight was increased from 77.5 to 80 kg/hl. Test weight is one of the grading factors in the U.S. marketing system. It is a key specification for the purchase of wheat, as a measure of density, higher test weight values are associated with higher extraction rates. High test weights are synonymous of high quality kernels which reduce milling costs increasing flour yields and flour purity (Parcell and Stiegert 1998).

Protein content is the most critical factor considered by wheat buyers (Stiegert and Blanc 1997). Interestingly, the largest change in utility for the milling companies surveyed in both countries occurs when protein content increases from 11 to 12 %. In fact, some millers pointed out that the minimum protein content they consider

Table V-6. Attribute- Based Utility Function Calculated from the Self-Explicated Method for Mexican and Peruvian millers

Attribute: Wheat class	**Mexico**	**Peru**
US HRW	0.958	2.000
	(3.129)	(2.828)
US HWW	-1.229	-2.000
	(2.008)	(2.828)
Attribute: Test weight (Kg/hl)		
75	-6.377	-5.539
	(1.313)	(0.762)
77.5	-2.230	-2.144
	(2.108)	(0.504)
80	2.655	3.216
	(1.210)	(1.013)
82.5	3.646	4.466
	(1.905)	(0.755)
Attribute: Protein content (%)		
11	-9.694	-9.062
	(4.906)	(0.443)
12	1.375	1.562
	(4.237)	(0.442)
13	6.017	5.937
	(2.163)	(0.441)
14	4.112	1.562
	(3.476)	(0.442)
Attribute: Falling number (Seconds)		
290	-6.735	
	(5.465)	
310	-4.302	-4.514
	(2.549)	(0.098)
330	-2.080	-3.681
	(2.484)	(1.276)
350	1.142	-0.347
	(2.548)	(1.080)
370	2.587	0.486
	(3.203)	(0.098)
390	3.791	2.570
	(2.635)	(0.491)
410	4.143	5.487
	(3.208)	(0.099)

Attribute: Stability (Min.)	**Mexico**	**Peru**
9	-2.888	
	(2.203)	
12	-0.898	-8.164
	(3.810)	(3.304)
15	0.768	2.501
	(3.689)	(7.069)
18	2.052	2.831
	(2.675)	(1.883)
21	2.181	2.832
	(2.694)	(1.883)
Attribute P/L ratio		
0.8	-5.117	
	(3.079)	
1	-1.408	-6.800
	(4.528)	(0.566)
1.2	0.548	-0.800
	(2.701)	(0.566)
1.4	0.837	3.200
	(1.846)	(2.267)
1.6	1.450	2.700
	(1.487)	(1.273)
1.8	1.773	1.700
	(4.593)	(0.141)
Attribute: W value (10^{-4} Joules)		
220	-5.002	-6.390
	(2.818)	(1.179)
240	-3.629	-4.473
	(1.932)	(0.825)
260	-1.200	-0.639
	(1.188)	(0.118)
280	1.832	1.278
	(1.233)	(0.236)
300	3.259	5.112
	(1.557)	(0.943)
320	4.184	5.112
	(1.368)	(0.943)
Attribute: Price		
210	11.111	11.250
	(3.090)	(1.768)
220	5.556	5.625
	(1.545)	(0.884)
230	0.000	0.000
	(0.000)	(0.000)
240	-5.556	-5.625
	(1.545)	(0.884)
250	-11.111	-11.250
	(3.090)	(1.768)

Source: Survey data.
Numbers in parentheses are standard deviation values.

when buying hard wheat is 11.5 %. For the millers in both countries, utility reaches a maximum at 13 % and then it starts decreasing. It seems that when millers need wheat with very high protein content, they will choose another wheat class such as hard red spring.

Increasing falling number values increase millers' utility. In Mexico wheat millers still consider buying wheat with a falling number of 290 seconds. However this level of falling number provides the lowest utility among all the levels evaluated. In both countries, the most preferred level of falling number is 410 seconds, the largest change in utility occurred when falling number increases from 330 to 350 seconds. High falling number values indicate low alpha amylase activity. Flour made of wheat with low falling numbers (high alpha-amylase activity) cannot be fixed, is harder to blend, and the resulting flour produces a sticky dough that create problems during processing, giving as result products with poor color and texture (U.S. Wheat Associates).

As expected, larger stability times are preferred. Mexican millers consider buying wheat that produces flour that will have a stability value of 9 minutes, and even though this level is acceptable, it produces the lowest utility. In contrast to Mexican, the Peruvian millers surveyed will not buy wheat if the resulting flour will have a stability time of 9 minutes. The largest change in utility for Mexican millers occurs when the stability times are up from 9 to 12 minutes while the largest change in utility for the Peruvian millers occurs when stability increases from 12 to 15 minutes. In Mexico, millers are not very responsive to changes in stability from 18 to 21 minutes. The preference for increased values of stability can be explained because higher values of this attribute indicate that the dough will maintain a maximum consistency for a longer period of time, also larger stability times are associated to strengthen dough.

The results of this study indicate that higher P/L ratio values are increasingly preferred. An increase of the P/L ratio values will increase Mexican millers' utility being 1.8 the level where the utility reaches a maximum. Peruvian millers prefer P/L ratios of at least one, different from the Mexican milling companies. For the Peruvian millers, the utility function will reach a maximum when the P/L ratio has a value of 1.6, a posterior increase of the P/L ratio will start decreasing their utility. For the Mexican millers, the highest change in utility occurs when P/L ratio goes up from 0.8 to 1.0. For the Peruvian millers the highest change in utility occurs when P/L ratio increases from 1 to 1.2. Findings suggest that millers in both countries place a higher valuation in dough strength over extensibility. Flours with low P value (weak gluten) and long L value (high extensibility) are preferred for confectionary products, while flours with high P values (strong gluten) are preferred for bread. (US Wheat Associates). The reason behind the preference for flours with higher P values which will result on flour with higher P/L ratios can be explained by the fact that flour to produce bread account for a sizable portion of the total flour produced in both countries.

Millers utility increases as the alveograph W value (10^{-4} Joules) increases. For millers in both countries, the increase in utility follows an upward trend among the levels considered in the survey, with a W value of 320 (10^{-4} Joules) being the most preferred. For Mexican millers, the highest change in utility occurs when W value is up from 260 to 280 (10^{-4} Joules). For Peruvian millers, the highest change in utility occurs when W value increases from 240 to 260 (10^{-4} Joules). The alveograph W value is considered to be closely related to flour strength (Faridi and Rasper 1987). Therefore a higher alveograph W value implies a strengthen dough which is very desirable to the production of bread. Alveograph test results (P, L, and W value) allow the miller to predict processing effects such as mixing requirement for dough development, tolerance to over-mixing and dough consistency during production (Wheat Marketing Center 2008)

According to the law of demand there is an inverse relation between price and quantity. As expected, as prices go up millers' utility decreases.

Willingness to pay estimates

One of the objectives of this research was to determine willingness-to-pay for U.S. HWW, in selected Latin American countries. More specifically, we are interested with the millers WTP for U.S. HWW versus U.S. HRW.

Marginal willingness-to-pay (MWTP) is the amount of money a person would have to give up to be indifferent between towards a one unit increase in the quality characteristic. As previously explained, this value is the slope of the attribute *j* divided by the slope of price multiplied by -1. Table V-7 shows the average MWTP for the milling companies surveyed in Mexico and Peru.

The attributes with the higher marginal Willingness to pay for the milling companies in our study, coincide with those found in a previous study conducted by Gallardo et al (2009) in Mexico. Results of our study show that Mexican millers are willing to pay the most for a marginal increase in P/L ratio, protein content, and test weight ($17.93/MT, $9.76/MT, and $3.19/MT, respectively), while Peruvian millers are willing to pay the most for a marginal increase in protein content, P/L ratio and test weight ($ 8.94/ MT, $7.25/ MT and $2.48/MT, respectively). Findings remark the

Table V-7. Mean Marginal Willingness-To-Pay for Hard Wheat Attributes

Willingness –To-Pay for a Marginal change in…	Mexico	Peru
	Willingness-To-Pay (USD/MT)	Willingness-To-Pay (USD/MT)
Class of Wheat HWW-HRW	-1.454	-6.400
Class of Wheat standard deviation	8.330	9.051
Test Weight (Kg/hl)	3.197	2.489
Test Weight standard deviation	1.397	0.313
Protein content (%)	9.767	8.94
Protein (%) standard deviation	4.552	3.867
Falling number (sec)	0.195	0.220
Falling number standard deviation	0.136	0.072
Farinograph stability (min)	1.289	1.943
Farinograph stability (min) standard deviation	0.937	0.403
Dough strength vs. extensibility (P/L) ratio	17.939	7.25
Dough strength vs. extensibility (P/L) ratio standard deviation	16.558	0.901
Alveograph W value (10^{-4} Joules)	0.205	0.206
Alveograph W value (10^{-4} Joules) standard deviation	0.077	0.050

Source: Survey data.

importance that end-use quality attributes (i.e., P/L ratio) have for the milling industry, especially in Mexico.

Contrary to what we expected, based on the multiple advantages of U.S. HWW over U.S. HRW, and holding other attributes constant, the wheat millers that participated in this study from Mexico and Peru are not willing to pay a premium price to buy U.S.

HWW. The findings of this study suggest that wheat millers have to be compensated (pay lower prices) to start buying U.S. HWW instead of U.S. HRW. Millers in Mexico consider on average a discount of $1.45/MT while millers in Peru consider a discount of $6.40 /MT. Thus the hypothesis that millers are willing to pay more to buy U.S. HWW is not supported by survey analysis in this study.

The results for the marginal value of test weight for Mexico and Peru, $3.49/MT and $2.48/MT, respectively, are similar to results found in previous studies. Uri et al (1994) analyzed the effect of the grain quality factors evaluated by the U.S. Federal Grain Inspection Service (FGIS) on the price paid by wheat importers. They found that test weight was statistically significant in explaining the export price for U.S. HRW. Their study shows that the estimated marginal value for an increase in test weight is $4.28/MT.

Moreover, the marginal value of protein is within the range that previous studies of international wheat markets have found. Ahmadi-Esfani and Stanmore (1994) found protein content to have a significant influence on price. Their study shows that the estimated marginal value of protein content for Australian hard wheat exports is $8.80/MT. Wilson (1989) estimated the marginal value of protein FOB U.S. Pacific market is $8.18/MT for U.S. HRW. Our results are considerable lower than those found by Gallardo et al (2009), who found that the marginal value of protein content for U.S. HRW is $23.21/MT. A direct comparison of the results from our study with the results of Gallardo is inappropriate as our study includes a wider range levels for most of the quality attributes evaluated in the survey. As an example, in this study the number of protein content levels are four (11 to 14 %) compared to three protein levels in Gallardo's study (11 to 13%).

Estimates of marginal willingness–to-pay are of interest; however it will be more realistic to estimate the value of moving from a low to a high level of each attribute over the range considered in this study. Table V-8 reports values from the lowest level to the highest level employed in the survey. The willingness-to-pay estimates are obtained by multiplying the marginal willingness-to-pay by the difference between the high and low quality level.

Table V-8. Mean Willingness-To-Pay for a Higher Level of Hard Wheat Attributes

Willingness –To-Pay for …	Mexico	Peru
	Willingness-To-Pay ($/MT)	Willingness-To-Pay ($/MT)
Test Weight (Kg/hl): 75 versus 82.5	19.162	18.667
Test Weight standard deviation	6.703	2.334
Protein (%): 11 versus 14	33.200	26.820
Protein (%) standard deviation	11.608	11.6
Falling number (sec) : 290 versus 410	21.449	22.06
Falling number standard deviation	14.986	7.21
Farinograph stability (min) : 9 versus 21	13.537	17.189
Farinograph stability (min) standard deviation	10.162	3.351
Dough strength vs. extensibility (P/L) ratio: 0.8 versus 1.8	15.050	5.80
Dough strength vs. extensibility (P/L) ratio standard deviation	13.158	0.721
Alveograph W value (10^{-4} Joules): 220 versus 320	19.359	20.6
Alveograph W value (Joules) standard deviation	7.298	5.048

Source: Survey data.

Results indicate that milling companies in both countries are willing to pay the most for an increase in protein content from 11% to 14%, for an increase in falling number from 290 to 410 seconds, for an increase in alveograph W value from 220 to 320 (10^{-4} Joules), and for an increase in test weight from 75 to 82.5 Kg/hl. The willingness to pay estimates are $33.20/MT, $21.49/MT, $19.35/MT, and $19.16/MT, respectively for Mexican millers while the willingness to pay estimates are $26.82/MT, $22.06/MT, $20.06/MT, and $18.66/MT, respectively, for the Peruvian millers.

A higher willingness-to-pay for an improvement on the level of protein content does not come as surprise, given that protein content is related to processing properties as well as finished product attributes such as texture and appearance (Wheat Marketing Center 2008). Mexican millers show a higher valuation for an increase in protein content from 11 to 14 %, they are willing to pay $33.20/MT while Peruvian millers are willing to pay just $26.82/MT for the same increase in protein content.

Results from improving the falling number from a low of 290 to 410 seconds, $21.44/MT in this study, are very similar to a previous result found by Gallardo (2007), who found that the Mexican millers are willing to pay $21.29/MT for an increase in the falling number from 300 to 400 seconds for U.S. HRW.

Millers are willing to pay $19.35/MT and $20.6/MT in Mexico and Peru respectively, for an increase on the W value from 220 to 320 (10^{-4} joules). W value combines the information from P and L value (Wheat Marketing Center 2008).

Finally, the willingness to pay for an increase in test weight from 75 to 82.5 (Kg/hl) for the millers surveyed in both countries is very similar. The values are $19.16/MT and $18.66/MT for Mexico, and Peru respectively.

CONCLUSIONS

This study investigated the preferences of milling companies for several hard wheat attributes in Mexico and Peru. The present study uses a survey composed of two sections. In the first section, general information about the millers, types of wheat purchased, flour production outlook, and perceptions about U.S. HWW was collected. In the second part of the survey the Self Explicated Method was used to elicit the preferences of milling companies regarding several hard wheat attributes.

Specific conclusions

First, from the methodological point of view, it is important to note that the results obtained from the Self Explicated Method proved to be consistent with those found in a previous study, which used a Conjoint Analysis method to elicit wheat miller's preferences in Mexico. Both methodologies identified the same set of attributes as being the most valued for the millers surveyed. Even dough the Self Explicated Method is a quite simple methodology to elicit consumer preferences, it can yield the same results as the more complex conjoint type methods.

Secondly, the U.S. wheat industry should conduct intensive market development activities to promote U.S. HWW such as in-plant technical demonstrations of U.S HWW milling advantages. It has to be demonstrated that U.S. HWW possess a significant economic advantage over the traditional U.S HRW. Payment of premium prices will likely occur when the advantages to flour millers of using U.S. HWW in flour milling exceed the premiums paid for this type of wheat.

Thirdly, the millers surveyed stated that storage costs and adjustments to the milling equipment are not factors that will prevent them from buying U.S. HWW. The handling and processing an additional class of wheat is feasible with no significant additional costs for the milling companies that participated in this study. Once the economic value of U.S. HWW is demonstrated to the milling companies, there will not be significant obstacles at the miller level to buy this type of wheat.

Fourthly, results suggest that milling companies in Mexico place considerable valuation in end-use quality attributes. In fact, the MWTP for P/L ratio was nearly twice the MWTP for protein content. Millers in both countries exhibited considerable willingness-to-pay values for attributes typically specified during the wheat purchasing process (i.e. protein content and test weight).

Finally, at this time it seems unlikely that premiums prices for U.S. HWW will come from the input or outputs markets in the countries evaluated. Therefore, if wheat breeders can release improved U.S. HWW varieties that increase revenues from yield enhancement or significant improvements in the flour quality, the new HWW varieties will provide another incentive to expand the domestic production of this type of wheat.

Limitations and Future research

First, the study was conducted in Mexico and Peru; however after repeated attempts unfortunately we could not get answers in other countries that are representative buyers of U.S. wheat in the region. Therefore, prudence is required in dealing with the results from this study, as Latin America as a region is a vast and multicultural place where the desirability of many of these characteristics depends upon the specific end use.

Secondly, the Self Explicated Method allows estimating consumer preferences and willingness to pay values for product attributes. However, one disadvantage of the SEM is that survey respondents are unable to see directly the consequences of their ratings scores and the trade-offs implied. Therefore, future research may evaluate consumers' preferences in context where survey respondents' decisions have real economic consequences (i.e. hybrid methods).

Thirdly, at the supply chain level, it is necessary to establish if wheat elevators within each state interested in expanding the production of HWW possess enough storage capacity to handle both types of wheat HWW, and HRW. It is important to assess the added costs of handling at the elevator hard wheat by type, and quality. In the absence of premium prices for U.S. HWW in international markets, a gain in efficiency at the elevator level might compensate the extra handling costs associated.

Finally, the introduction of a new wheat class in the marketplace might generate a substitution effect on the millers among the hard wheat classes traded. This substitution effect should be carefully considered, as price movements in one class will have an effect on the demand for other hard wheat classes.

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APPENDICES

APENDIX A-

INSTITUTIONAL REVIEW BOARD LETTER

Oklahoma State University Institutional Review Board

Date:	Monday, August 24, 2009
IRB Application No	AG0932
Proposal Title:	Production and Marketing Opportunities for Hard White Wheat in Oklahoma
Reviewed and Processed as:	Exempt

Status Recommended by Reviewer(s): Approved Protocol Expires: 8/23/2010

Principal Investigator(s):

Shida R. Henneberry 424 Ag Hall Stillwater, OK 74078	Fredy Ballen 421-K Ag Hall Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

☒ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Beth McTernan in 219 Cordell North (phone: 405-744-5700, beth.mcternan@okstate.edu).

Sincerely,

Shelia M. K.

Shelia Kennison, Chair
Institutional Review Board

APENDIX B-

SURVEY ON HARD WINTER WHEAT QUALITY PREFERENCES

OKLAHOMA STATE UNIVERSITY

OSU

Division of Agricultural Sciences and Natural Resources
Department of Agricultural Economics
308 Agricultural Hall
Stillwater, Oklahoma 74078-6026
405-744-6157, 6154, 6081, 6086
Fax 405-744-8210

August 2009

8/24/09
8/23/10
AG0932

Dear Purchasing Manager:

This study is part of the research work on the project entitled: "Production and Marketing Opportunities for Hard White Wheat in Oklahoma". In this survey, you will be asked about several grade and non-grade wheat attributes, you will be asked to rate different wheat attribute levels and the relative importance of each attribute based on the milling needs of your company. By simply completing this short survey, you help us at Oklahoma State University assist exporters and policy makers in the U.S. and global markets. This research study will focus on the impacts of policies and marketing strategies related to different types of wheat grown in the U.S. and other exporting countries.

The information provided by you will help us to better understand your **current** hard wheat purchasing needs. Your participation is requested for one time only and this survey should not take more than 15-20 minutes to complete. Participation in the survey is voluntary and may be discontinued at any time without penalty. By sending back the survey to us you indicate your willingness to participate in the study. Please return the survey no later than one week after you receive it. All survey responses will be kept **strictly confidential.** Any written results will discuss group findings and will not include information that can identify any individual firm. Only researchers and individuals responsible for research oversight will have access to the documents. Once you return the survey by email, surveys will be printed and the electronic files will be deleted. Hard copies of the surveys will be kept in Dr. Henneberry's office in a locked cabinet and will be destroyed after two years. If you have any questions regarding this survey, please do not hesitate to contact us at 405-744-6178 or srh@okstate.edu.

Sincerely,

Dr. Shida Henneberry, Professor
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Note: If you have questions about your rights as a research volunteer, you may contact Dr. Shelia Kennison, IRB Chair, 219 Cordell North, Stillwater, OK 74078, 405-744-1676 or irb@okstate.edu. There are no known risks associated with this project which are greater than those ordinarily encountered in daily life.

SURVEY

LATIN AMERICAN MILLERS WHEAT PURCHASING PREFERENCES

Miller' Information

Your Name:

Company Name:

E-mail Address:

Phone Number:

Fax Number

Postal Address:

I. Background information

As part of the purchasing process for your company, you are familiar with the specifications of ***Hard Red Winter*** Wheat. The following information refers to ***Hard White*** Wheat, a wheat class that you may or may not have purchased. In the last few years Canada and the United States have been increasing the production of ***Hard White*** Wheat, a class of wheat that possesses several particular characteristics such as:

- A slightly less bitter after-taste in the final product.
- Because of the less bitter after-taste, less sugar needs to be added to the flour.
- Flour has a whiter color.
- Because the bran can be milled, flour made from Hard White Wheat has higher fiber content and a lighter color.

II. Questionnaire

The purpose of this survey is to measure your preference for certain wheat attributes. In the following questions, you will be asked about your preferences regarding certain ***Hard Wheat*** attributes, first you are asked to identify if there is any level which is *totally unacceptable* to you with the option n/a (you will not buy it). Then you will rate the remaining levels in a scale of 0 to 10; with 0 indicating extremely undesirable, while 10 indicating extremely desirable.

2. Assume you are about to purchase wheat for your company. In the following table, you are asked to identify if there is a wheat class that is *totally unacceptable* to you n/a. Then you will rate for the remaining levels, on a scale of 0 to 10, how desirable each wheat class is to your milling needs, assuming that all wheat classes have the same levels of: test weight, falling number, protein content levels, and all other attributes. N/F implies you are not familiar with this type of wheat.

Level	**Wheat class**	**Circle the number of how desirable each attribute level is:** **n/a= Unacceptable** **0= Extremely undesirable** **5= Neutral** **10= Extremely desirable**											
1	US Hard Red Winter	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2	US Hard White Winter	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
3	Canadian Western Hard White Spring	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Suggestions/observations:

3. Assume you are about to purchase wheat for your company. In the following table, first you are asked to identify if there is any test weight level that is *totally unacceptable* n/a to you (you won't buy it). Then for the remaining levels you will rate on a scale of 0 to 10, how desirable each **test weight** level is to your milling needs.

Level	**Test Weight (Kg/hl)**	**Circle the number of how desirable each attribute level is:** n/a= Unacceptable 0= Extremely undesirable 5= Neutral 10= Extremely desirable											
1	70	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2	72.5	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
3	75.0	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
4	77.5	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
5	80.0	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Suggestions/observations:

4. Assume you are about to purchase wheat for your company. In the following table, you are asked to rate, on a scale of 0 to 10, how desirable each **<u>protein</u>** level is to your milling needs.

Level	**Protein content % (12% moisture basis)**	**Circle the number of how desirable each attribute level is:** **n/a= Unacceptable 0= Extremely undesirable 5= Neutral 10= Extremely desirable**											
1	8	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2	9	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
3	10	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
4	11	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
5	12	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
6	13	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
7	14	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Suggestions/observations:

5. Assume you are about to purchase wheat for your company. In the following table, you are asked to rate, on a scale of 0 to 10, how desirable each **falling number** is to your milling needs.

Level	Falling Number (seconds)	Circle the number of how desirable each attribute level is: n/a= Unacceptable; 0= Extremely undesirable; 5= Neutral; 10= Extremely desirable											
1	230	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2	250	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
3	270	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
4	290	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
5	310	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
6	330	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
7	350	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
8	370	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
9	390	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
10	410	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Suggestions/observations:

6. Assume you are about to purchase wheat for your company. In the following table, you are asked to rate, on a scale of 0 to 10, how desirable each **stability** level is to your milling needs.

Level	Stability (Minutes)	Circle the number of how desirable each attribute level is: n/a= Unacceptable 0= Extremely undesirable 5= Neutral 10= Extremely desirable											
1	3	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2	6	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
3	9	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
4	12	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
5	15	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
6	18	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
7	21	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Suggestions/observations:

7. Assume you are about to purchase wheat for your company. In the following table, you are asked to rate, on a scale of 0 to 10, how desirable each **<u>P/L ratio</u>** is to your milling needs.

Level	P/L Ratio *	Circle the number of how desirable each attribute level is: n/a= Unacceptable; 0= Extremely undesirable; 5= Neutral; 10= Extremely desirable											
1	0.40	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2	0.60	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
3	0.80	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
4	1.0	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
5	1.20	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
6	1.40	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
7	1.60	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
8	1.80	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

*P/L ratio is the balance between dough strength and extensibility.

Suggestions/observations:

8. Assume you are about to purchase wheat for your company. In the following table, you are asked to rate, on a scale of 0 to 10, how desirable each **W value** is to your milling needs.

Level	**W Value (10^{-4} Joules)**	**Circle the number of how desirable each attribute level is:** n/a= Unacceptable; 0= Extremely undesirable; 5= Neutral; 10= Extremely desirable											
1	180	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2	200	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
3	220	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
4	240	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
5	260	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
6	280	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
7	300	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
8	320	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Suggestions/observations:

9. Assume you are about to purchase wheat for your company. In the following table, you are asked to rate, on a scale of 0 to 10, how acceptable each **price** level is to you.

Level	Price FOB* (USD/MT)	Circle the number of how desirable each attribute level is: n/a= Unacceptable; 0= Extremely undesirable; 5= Neutral; 10= Extremely desirable											
1	210	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
2	220	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
3	230	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
4	240	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
5	250	**n/a**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

*Prices are FOB US Gulf port

Suggestions/observations:

10. Below is a list of the attributes which you rated in the previous tables. In the following table, please indicate the ***relative*** importance of each attribute to you. For example, how important is a change in test weight relative to a change in falling number? Please allocate 100 points across each of the different attributes listed.

Attribute	**Points allocated**
Wheat class Hard Red Wheat vs. Hard White Wheat	/100
Test weight (70 vs. 82.5 Kg/hl)	/100
Falling number (230 vs. 410 Seconds)	/100
Wheat protein content (8 vs. 14%)	/100
Stability (3 vs. 21Minutes)	/100
P/L ratio (0.40 vs.1.80)	/100
W value (180 vs. 320(Joules)	/100
Price (210 vs. 250 USD/MT)	/100
Total	**100**

Suggestions/observations:

III. Additional information

10. Which of the following factors would prevent you from buying ***Hard <u>White</u> Wheat***? (Please check all those that apply).

( ) Not familiar with Hard White Wheat specifications.

Please rate the importance of the above factor on a scale of 1 to 5, where 1 is ***<u>slightly</u>*** relevant and 5 is ***<u>very</u>*** relevant:

1 2 3 4 5

( ) Not enough volume year round supplied.

Please rate the importance of the above factor on a scale of 1 to 5, where 1 is ***<u>slightly</u>*** relevant and 5 is ***<u>very</u>*** relevant:

1 2 3 4 5

( ) Additional operational costs, such as adjustments in the milling equipment.

Please rate the importance of the above factor on a scale of 1 to 5, where 1 is ***<u>slightly</u>*** relevant and 5 is ***<u>very</u>*** relevant:

1 2 3 4 5

( ) Additional storage costs, such as segregation costs to keep Hard Red Winter Wheat separated from Hard White Winter Wheat.

Please rate the importance of the above factor on a scale of 1 to 5, where 1 is ***<u>slightly</u>*** relevant and 5 is ***<u>very</u>*** relevant:

1 2 3 4 5

( ) Other reason (Please explain) ____

Please rate the importance of the above factor on a scale of 1 to 5, where 1 is ***<u>slightly</u>*** relevant and 5 is ***<u>very</u>*** relevant:

1 2 3 4 5

11. What are the major end uses of the flour sold by your company as a percentage of total wheat you mill in a typical year?

Bread ___ %

Noodles ___ %

Tortillas ___ %

Others ___ %

12. How much wheat (in <u>Metric Tons</u>) did you buy last year by class?

US Hard Red Winter Wheat:	_______________Metric tons.
US Hard White Winter Wheat:	_______________Metric tons.
US Hard Red Spring Wheat:	_______________Metric tons.
US Soft Red Winter Wheat:	_______________Metric tons.
US Soft White Winter Wheat:	_______________Metric tons.
Canadian Western Hard White Spring Wheat:	_______________Metric tons.
Canadian Western Red Spring Wheat:	_______________Metric tons.
Other :	_______________Metric tons.

13. Does your company sell whole wheat flour?

( ) Yes: If yes, give the percentage of your total production that is in whole wheat: ________%

( ) No

14. Do you think that the consumption of whole wheat flour will increase in the short run (next two years)?

( ) Yes: If yes, give your estimation of the percentage of total wheat flour consumption that will be in whole wheat flour: _____%

( ) No

15**.** Do you perceive *__any advantages__* in processing "*U.S. Hard White*" instead of "*U.S. Hard Red Winter*" *Wheat*?

( ) Yes: If yes, please give the reason(s) for your preference of *U.S. Hard White*" instead of "*U.S. Hard Red Winter* (check all that apply):

( ) Lighter color of flour.

( ) Higher fiber content in the flour.

( ) Higher flour extraction rate.

( ) A better after taste in the final product.

( ) Other: ____

( ) No

16. In your opinion, is there a preference in the end-use market for flour with a lighter color?

( ) Yes: If yes, which end users in your opinion prefer flour with a lighter color:

____

( ) No

18. What is the typical range of ash content **(14% moisture basis)** in the flour sold by your company?

( ) < 0.20

( ) 0.20 to 0.50

( ) 0.51 to 0.80

( ) 0.81 to 1.10

( ) 1.11 to 1.40

( ) 1.41 to 1.70

( ) > 1.71

19. Do you think your clients will accept higher **ash content** in the flour sold by your company?

( ) Yes If yes, what percentage of your total customers will accept it______%

( ) No

20. What is your Milling Installed Capacity?

_____________ TM/ Year.

21. What is your Real Milling Capacity?

_____________ TM/ Year.

Thank you so much for your time. Your opinion is highly valuable and your participation is greatly appreciated.

VITA

FREDY HERNAN BALLEN OROZCO

Candidate for the Degree of

Master of Science

Thesis: ASSESSMENT OF MARKET OPPORTUNITIES FOR U.S. HWW IN SELECTED LATIN AMERICAN COUNTRIES

Major Field: Agricultural Economics

Biographical:

Personal Data: Born in Bogotá, Colombia, on January 19, 1973, the son of Virgilio Ballen and Hilda Marlen Orozco.

Education: Graduated from Universidad Nacional de Colombia, Bogota Colombia in June 2001; received Bachelor of Science in Agronomy. Completed the requirements for the Master of Science in Agricultural Economics at Oklahoma State University, Stillwater, Oklahoma in July, 2010.

Experience: Employed as a research assistant in the Corporación Colombiana de Investigación Agropecuaria CORPOICA, January 2000-December 2001; employed as salesperson at Target stores Miami, Fl, December 2002-December 2006; employed as a graduate assistant at Oklahoma State University, Department of Agricultural Economics, January 2009-December 2009; employed as a teaching assistant at Oklahoma State University, Department of Agricultural Economics, January 2010-May 2010.

Name: Fredy H Ballen Date of Degree: July, 2010

Institution: Oklahoma State University Location: Stillwater, Oklahoma

Title of Study: ASSESSMENT OF MARKET OPPORTUNITIES FOR U.S. HWW IN SELECTED LATIN AMERICAN COUNTRIES

Pages in Study: 75 Candidate for the Degree of Master of Science

Major Field: Agricultural Economics

Scope and Method of Study: In order to determine wheat millers' demand for hard winter wheat attributes in selected Latin American countries, the Self Explicated Method was administered through an e-mail survey in the Spanish language.

Findings and Conclusions: It was found that most of the wheat millers surveyed in Mexico are not completely familiar with U.S. HWW, in contrast the Peruvian millers surveyed have more familiarity with this type of wheat. Wheat millers in Mexico and Peru do not perceive any advantage of U.S. HWW over the traditional U.S. HRW. Mexican millers are willing to pay the most for a marginal increase in P/L ratio, protein content, and test weight, while Peruvian millers are willing to pay the most for a marginal increase in protein content, P/L ratio and test weight respectively. Millers in both countries are not willing to pay a premium price to buy U.S. HWW, to start buying this type of wheat they have to be compensated, in other words they have to receive a discount or lower prices. When moving from a low to a high level of each attribute in the range considered in this study, millers in both countries are willing to pay the most for an increase in protein content from 11 to 14%, for an increase in wheat falling number from 290 to 410 seconds, for an increase in alveograph W value from 220 to 320 (10^{-4} Joules), and for an increase in test weight from 75 to 82.5 Kg/hl. It seems unlikely that premium prices for U.S. HWW will come from the input or output markets in the countries evaluated. Therefore, if wheat breeders can release improved varieties that increase revenues from yield enhancement or significant improvements in the flour quality, the new U.S. HWW varieties will provide an incentive to expand the domestic production of this type of wheat.

ADVISER'S APPROVAL: Dr. Shida Henneberry